

PAPERS IN CONNECTION WITH THE BUBONIC PLAGUE.

THE FOLLOWING PAPERS ARE PUBLISHED FOR GENERAL INFORMATION—

Sanitary.

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No. 1135.—The following Note on Anti-plague Inoculations by Surgeon-Major-General R. Harvey, D.S., M.D., F.R.C.P., Officiating Director General of the Indian Medical Service, is published for general information:—

Note on Anti-plague Inoculations.—From the earliest times the treatment of plague has been the opprobrium of the medical profession, and the results of recent experience seem to show that it is so still. The case mortality both in China in 1894-96 and in India 1896-98 has ranged from 70 to 90 per cent and it seems to be pretty generally admitted that such cases as recover do so in virtue of inherent power of resistance rather than as a consequence of medical skill, although isolated cases are no doubt helped to recovery by treatment.

It is only since 1894, however, that the true cause of plague has been demonstrated as due to a pathogenic microbe. This was discovered at Hong-kong by Kitasato, and his observations have now been fully confirmed by other observers. Some such cause had for years been accepted by the profession as a matter of theory, founded on the analogous cases of small-pox, anthrax and other so called Tymotic diseases, and the results of bacteriological work had led to the belief that a remedy might be worked out on bacteriological lines similar to that found in vaccination against small-pox, and the preventive inoculations against anthrax, cholera, diphtheria, etc. No practical work could, however, be done until the theory had been proved to be a fact, and the general absence of plague in centres of scientific medical activity delayed the discovery until the outbreak in Hong-kong in 1894. This speedily proved that the theories were right, and gave a great impetus to the hope that a protective and curative treatment based on scientific principles might be worked out. This could only be done by experiment and, by practice, and time was required to prove its efficacy. Numerous experiments have been made both in the laboratory and in plague-stricken districts, some of which have been failures, others more or less successful. Some have been intended as preventive, some as curative, some as both. It must be remembered, however, that all these methods are tentative, that the experiments are only beginning, but the analogies mentioned above point to the fact that they are experiments in the right direction, and that we may hope for ultimate success.

The most promising results so far attained are those of M. Haffkine, and it is to this method especially that this Note is intended to call attention. The idea is to combine a preventive and curative method which shall eliminate or greatly diminish the risk of contracting the disease and at the same time reduce the case mortality. In his anti-cholera inoculations a bactericidal power is conferred on the individual by inoculations with attenuated common bacilli, so that when exposed to attack his system can resist and kill off the invading microbe in its natural condition. The result is diminished susceptibility and a consequent reduction of the absolute mortality; but when an inoculated individual does get the disease the case mortality has so far been little affected.

In his anti-plague inoculation he uses the bacilli of plague to confer a bactericidal power, which shall enable the individual to resist the same in its natural form; but goes a step further and by injecting the toxins secreted by the bacilli in the cultivating medium in which they grow, he strives to produce an anti-toxic effect in the tissues which shall enable the patient to throw off the poison if it should gain access to his system and so reduce the case mortality. He frankly states that the process is based on hypothetical considerations and that time and experiment alone can prove the validity of his conclusions.

It must be obvious that an experiment of this kind must be tried on a large scale before any trustworthy conclusions can be drawn, and that many difficulties and possible sources of fallacy will be met and must be disposed of before we are entitled to say that events following inoculations are effects and not sequences.

Thus plague may disappear from a village immediately after inoculations have been done. It by no means follows that the inoculations have been the cause of the

disappearance. The disease may have come to an end at this particular time and the inoculations be no more than a coincidence. Similarly the exemption of a jail or other inoculated community may have no connection with the inoculation, but be due to the fact that the plague bacillus has never been introduced, in which case there could have been no plague though inoculation had been done.

It is only when plague is actually present, and when inoculated and uninoculated persons are living together under similar conditions in the midst of it, that we can begin to draw conclusions by comparing the incidence of the existing epidemic on the two classes; and it is only when a number of instances like the above have shown that under similar conditions similar results invariably appear, that we gradually substitute the relation of cause and effect for that of mere sequence; every additional instance strengthening the induction until we arrive at scientific proof.

The results so far arrived at go so far to show that M. Haffkine is working on the right lines; that he has already obtained a measure of success which would justify the voluntary adoption of his method by the public; that there is reason to hope that still better results may follow from further experiment and observation; and that in time to be possible to expect as much from inoculation in the suppression of plague as we now do from vaccination in the stamping out of small-pox. At present, however, the process is too crude and imperfect to justify any compulsion on the part of Government, though it might well consider the advisability of holding out inducements to inoculations by conferring certain exemptions from unpalatable restrictions on those who have submitted themselves to it.

Before discussing such questions, however, it will be well to briefly record the results already attained in different places where the inoculations have been tried.

Bombay House of Correction.—Plague broke out towards the end of January 1897, and attacked 9 prisoners, 6 of whom died. On 30th January inoculation was offered to the prisoners, a number of teachers and students of the Grant Medical College being done in their presence to encourage them. Six additional cases, 3 fatal, occurred the same day among the non-inoculated, and 3 of the inoculated developed symptoms the same evening and also died. These cases are not included in the following figures, which show the results from the day after the inoculations, till the epidemic ended 8 days later.

	No.	Cases.	Per cent.	Deaths.	Per cent.
Uninoculated	173	12	6.94	6	3.49
Inoculated	148	2	1.35	...	0.00

Mora in the Kolaba district near Bombay has a population of about 1,000; 7 cases occurred among 429 inoculated persons. All recovered. During the same time there were 26 attacks among the uninoculated part of the population, 24 of which proved fatal.

Lower Damaon experienced a very severe visitation of plague in the cold season of 1896-97. The history of the epidemic was very carefully investigated by Surgeon-Major Lyons, and the figures show that some 2,197 persons were inoculated, while 6,033 remained uninoculated. Between the end of March and the end of May 1897, no less than 1,482 of the uninoculated died of plague. The inoculated lost only 36, whereas had they suffered at the same rate as their uninoculated neighbours, they should have lost 332—a saving of close on 90 per cent.

Lunauli.—In July 1897, M. Haffkine and his assistants inoculated 323 persons in the two wards most severely infected with plague, 377 others remaining uninoculated. Among these there were subsequently 78 cases and 58 deaths, while among the inoculated there were only 14 cases and 7 deaths, instead of 67 and 49 as there should have been had they remained as susceptible as their uninoculated relatives living beside them under identical conditions. Here the reduction in mortality was some 86 per cent.

Kirki had a severe epidemic in the autumn of 1897 in which the followers belonging to the Royal Artillery suffered heavily, in spite of all possible precautions taken by the Military authorities. These people numbered 1,530 living in about 40 barracks on the Kirki maidan. "Out of the total of 1,530 individuals," to quote M. Haffkine, "671 availed themselves of inoculation, while 859 belonging to the same families, living under the same roofs, having the same food, drink, etc., and subject to the same general

preventive measures adopted by the Military, remain uninoculated. From the time of inoculation up to the end of epidemic the 859 uninoculated had 113 cases with 98 deaths. Seeing the absolute similarity of the conditions, the 671 inoculated should have had proportionately 112 cases with 77 deaths, if they had remained as susceptible to the disease as were their uninoculated brothers, sisters, parents, wives, husbands, children. Instead of that they had 32 cases with 17 deaths. The number of 77 deaths was, therefore, reduced for them by 60, that is, by 77·9 per cent."

These cases all occurred before the recent recrudescence of plague in Bombay. A large mass of additional information has since been accumulated, but has not yet been worked out; although it all appears to point in the same direction. The two following instances, however, are complete, and have been most carefully verified:

Umarkadi Jail, Bombay, was attacked by plague in January 1898. About half the inmates had previously been voluntarily inoculated, the numbers on 1st January being—uninoculated 203, inoculated 198. A number of men were released during the month, others were inoculated, and on the 30th there were 106 uninoculated to 134 inoculated. Cases occurred throughout the month, ten in all with six deaths, all in uninoculated prisoners. No inoculated person was attacked, and the disease was believed to have disappeared. Since then, however, there have been three suspicious cases among inoculated persons, one on 10th February, one on 28th, and one on 18th March. All these have recovered, and the hospital authorities at Parel were not quite sure that they were cases of plague. If they were, they were so much modified as to be with difficulty recognisable. I saw two of them and they looked to me like mumps. Both parotids were equally affected (a rare thing in plague).

Undera, a village about six miles from Baroda, was attacked by plague in January 1898. On the 5th February a careful census was taken and showed a population of 1,029. Up to and inclusive of 14th February, 79 plague deaths occurred, leaving 950 people to be dealt with. Of these, 513 were inoculated, leaving 437 uninoculated. As far as possible an equal number of each sex, age and family were done, and as all were living under precisely similar conditions as to sanitary surroundings, food, drink, clothing, etc., the case is the best and most conclusive example yet available of the result of inoculation. Except for the inoculations all were on the same footing, and the disease had got a thorough hold of the place. The usual sanitary precautions as to segregation and disinfection were carried out, all plague cases being removed to hospital and every effort made to combat the disease in the usual way. The inoculations were done on the 12th, but the following figures are taken from the 15th, so as to eliminate cases incubating plague at the time of the inoculations. Three deaths occurred among the uninoculated between the 12th and 14th inclusive, none among the inoculated. These three deaths, together with two others which might possibly have been due to diseases other than plague, have been eliminated, so that no exaggeration as to the effects of the inoculation may be possible. The results up to 2nd April are as follows, but no case occurred after 26th March so that we are probably dealing with a finished epidemic. Between 15th February and the cessation of the disease plague cases occurred in 29 families living together as already said under exactly similar conditions, save that some were, and others were not, inoculated. These 29 families comprised 135 individuals of all ages, 71 of whom had been inoculated and 64 not. The 71 inoculated had 8 cases with 3 deaths while the 64 uninoculated had 28 cases with 26 deaths. Had the inoculated been as susceptible as the uninoculated, they should have had 29 deaths instead of three and the inference seems irresistible that the inoculations saved 26 lives out of this small number or 89·65 per cent. Taking the whole number inoculated, 513 had 8 cases or 1·56 per cent, and 3 deaths or ·58 per cent, while the 437 uninoculated had 28 cases or 6·4 per cent, and 26 deaths or 5·9 per cent just ten times as many.

The protective influence of the inoculations is brought out still more strongly in some particular instances. Thus in hut 84, ward 4, five persons were inoculated and five uninoculated in a family of ten. The five inoculated remained healthy, while two out of the five uninoculated got plague and died. In hut 18 of the same ward three inoculated persons remained healthy, two uninoculated died out of a family of five. In hut 26, also in ward 4, one inoculated person escaped, two uninoculated died out of a family of three. In hut 8, ward 1, four inoculated persons escaped, while the one who remained uninoculated contracted the disease and died. In hut 24, ward 2, out of a family of two the inoculated member escaped, the uninoculated died. In hut 20,

ward 3, one of three inoculated contracted the plague, but recovered, while one of four uninoculated got it and died.

In two out of the three huts where fatal cases occurred among the inoculated, a death also occurred among the uninoculated, and in only one instance in the whole village did a case occur among the inoculated, while the uninoculated went free. This was in hut 3E, ward 4, where one of four inoculated contracted and died of plague, while two uninoculated escaped.

These figures have been verified case by case and family by family, and seem to me to prove that while inoculation as at present practised is not an absolute protective either against seizure or death, it is of immense value both as a prophylactic and as modifying the severity of the disease and reducing the case mortality. This was 37·5 per cent among the inoculated against 92·85 in the uninoculated.

Suleiman Mussalmans at Baroda, a population of 404 living in an extremely dirty crowded locality. By the influence of their headman and Mullah 322 of these people have been inoculated and no plague has occurred among them although cases have been prevalent all round about them. They have been taken into camp in batches, while their houses have been cleaned, disinfected and whitewashed. This case *proves* nothing, but so far as it goes is favorable to inoculation.

The Khoja community of Bombay has been largely inoculated, but the figures are not yet available. It is believed, however, that only some 20 cases of plague have occurred among several thousands inoculated, and that only three or perhaps four have been fatal.

Similarly, out of some six hundred inoculated dependents of His Highness Aga Khan at Poona all are believed to have escaped plague though mixing freely with the general community among whom the disease was exceedingly severe.

The people at Unera are thoroughly convinced of the efficacy of inoculation, and those of a neighbouring village (Jotai), where plague is now prevalent, sent in a deputation of their headman to implore that they might be done. Arrangements were made to do as many as possible the following day.

It seems to me that these cases go very far to show the great value of the process. Those at Daman and Unera have been carefully verified by independent observers, while some of the others have been already published and have not been challenged. How long the protection lasts can only be established by time, but were it only for a few months, we should have a valuable aid in saving people from attack during an existing epidemic. There is reason to believe, however, that it lasts much longer than this, for the larger numbers inoculated during the first epidemic both in Bombay and Poona have, with a very few exceptions, escaped the disease during the recrudescence.

The position, therefore, seems to warrant Government in extending facilities for inoculation and inducing the people to accept it by all legitimate means. The serum takes some six weeks to prepare and the technique of the process requires great care and can only be carried out by experts, but the actual inoculations can be done by any Medical Officer according to printed instructions. The operation is painless, but the serum causes a certain definite re-action in which the temperature rises to about 102°F. and local irritation at the seat of infection usually lasts for some days and is frequently severe. This makes people shy of undergoing inoculation unless they have something to gain by it and the fear of plague is in many instances insufficient to overcome these objections. Most people take an optimistic view of their chances of escaping plague—as Young says “all men think all men mortal but themselves”—and considering that the total mortality in both the Bombay outbreaks has been little more than 3 per cent, the chances of an individual's escaping are very large—thirty-two to one.

*Extract from the Diary of the Acting Assistant Superintendent of Police,
Hussar District, for the Week ending 21st May 1898.*

Above all I am glad to note that I saw a few note books in the possession of the patels I met with, containing entries on fly leaves of necessary instructions regarding village sanitation, and signed by the Amildar of Manjarabad, and I learned that he (the Amildar) distributed note books of the same kind for the use of other patels of his taluk. So I hope this system will be very useful for their daily reference when attending to sanitation work.